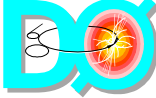# Data Collection for the Forward Proton Detector

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Standalone DAQ

➢ We are still in a standalone configuration where the Trigger signals are arriving in the SCR and the MAPMT signals from P1D and P2D are arriving as well.

➢ We create our trigger logic using NIM modules.

➢ Single rates, LVDT values are sent through EPICS to ACNET for observation and logging through Lumberjack

➢ We have used elastic triggers to plateau the trigger tubes in the tunnel and have been operating at these values
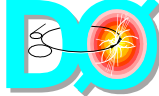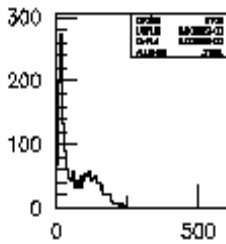
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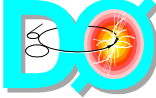
Elastic Trigger

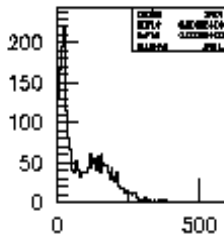➤ Basic trigger involves in-time hits in the AU and PD spectrometer
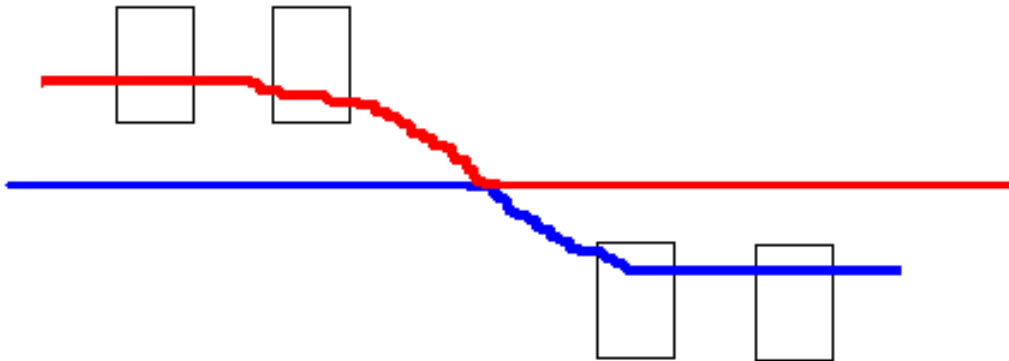
➤ We veto if there are any early hits in any of the spectrometer components

➤ We veto if there are any hits in the Luminosity monitors (N or S)

➤ We veto if there are hits in the Veto counters
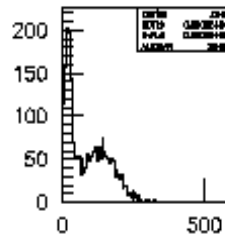
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ADC Distributions

U2(1) ped sub ADC w/TDC cuts U2(2) ped sub ADC w/TDC cuts U2(3) ped sub ADC w/TDC cuts U2(4) ped sub ADC cuts

U2(5) ped sub ADC w/TDC cuts U2(6) ped sub ADC w/TDC cuts U2(7) ped sub ADC w/TDC cuts U2(8) ped sub ADC w/TDC cuts

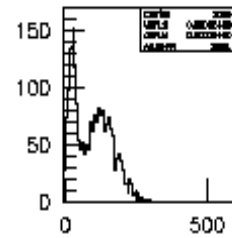U2(9) ped sub ADC w/TDC cuts U2(10) ped sub ADC w/TDC cuts U2(11) ped sub ADC w/TDC cuts U2(12) ped sub ADC w/TDC cuts
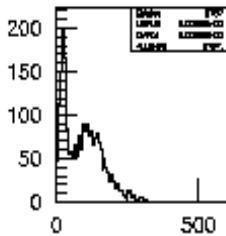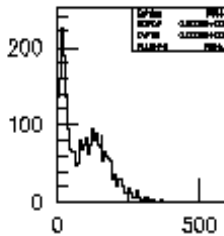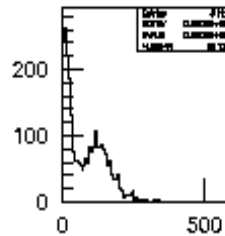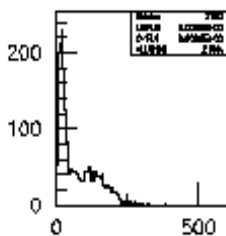
U2(13) ped sub ADC w/TDC cuts U2(14) ped sub ADC w/TDC cuts U2(15) ped sub ADC w/TDC cuts U2(16) ped sub ADC w/TDC cuts
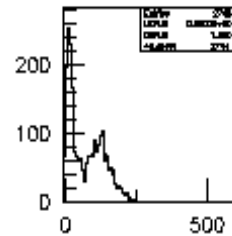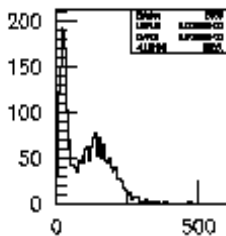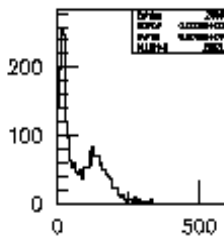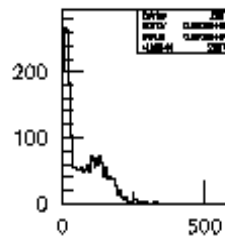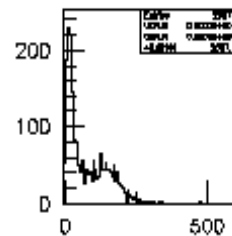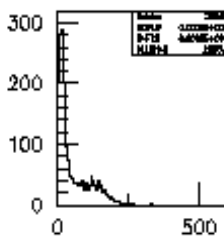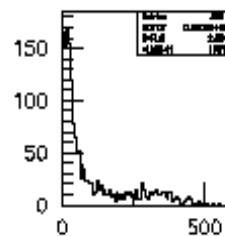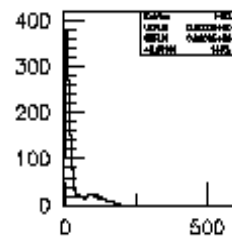
➢ Spectra for plane U in P2D from elastic trigger.

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Data from Trigger

➢ We have moved logic units from ands to ors in the vetos to provide greater rejection

➢ Reduced trigger rate from ~80Hz to ~20Hz

➢ A rate of ~20Hz is still much larger than expected (expect a few hz)

➢ Looking at the data, the majority of hits are spread out geometrically throughout the active area of the detector (indicates most hits are not physics related).
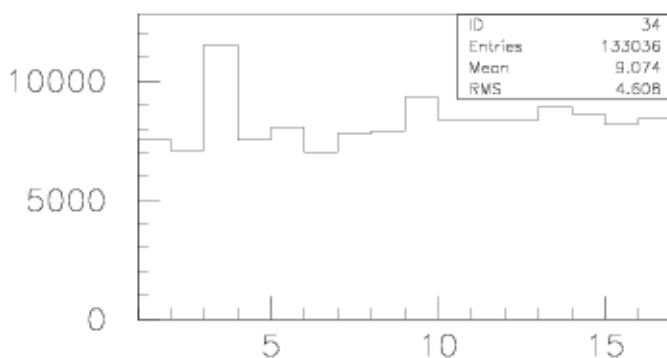
XP1 Hit Distribution (no mult cut)

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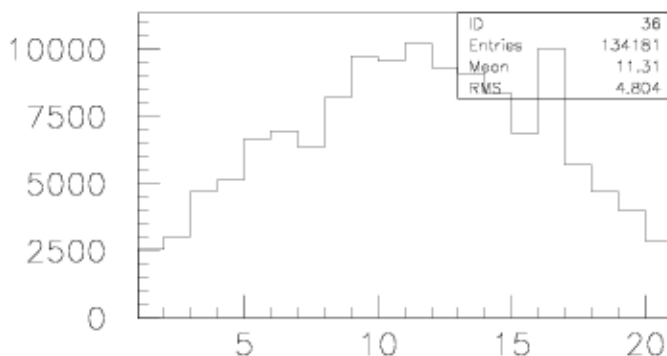
Data Collected

➢ Since January we have collected 108 runs with an average of ~30k events each.

➢ Soon after collection data is transferred to d0mino in the fp_1 area where it is unpacked into a PAW ntuple where it can be analyzed.

 – Unpacked data in FPD_data/unpacked directory by month collected.

 – Raw data and peds stored in FPD_data directory by month collected (peds referenced by run numbers they apply to).

➢ The ntuple contains run number, event number, tdc information, adc information and scaler information.

➢ Some early runs have repeated events that need to be filtered out during analysis

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Underlying "Real" Events

➢ Applying a multiplicity cut that only allows one or no fibers to be "on" in a frame give valid events (rough discrimination cut of 50 ADC counts on all channels)

➢ Applying a multiplicity cut that each plane (U, X and V) have one hit gives us some possible valid elastic events

➢ For Runs74-78 such a cut takes us from ~50k events to ~1.5k events.

➢ Fiber distribution look closer to what we would expect

➢ Need to study data further since there are likely more events than this that are "clean" with a clever way of cleaning the data

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Tracking

➤ Using these events, we tried to reconstruct the xi and t values of the elastics

ID	10
Entries	1069
Mean	0.6507E−01
RMS	0.6039E−01
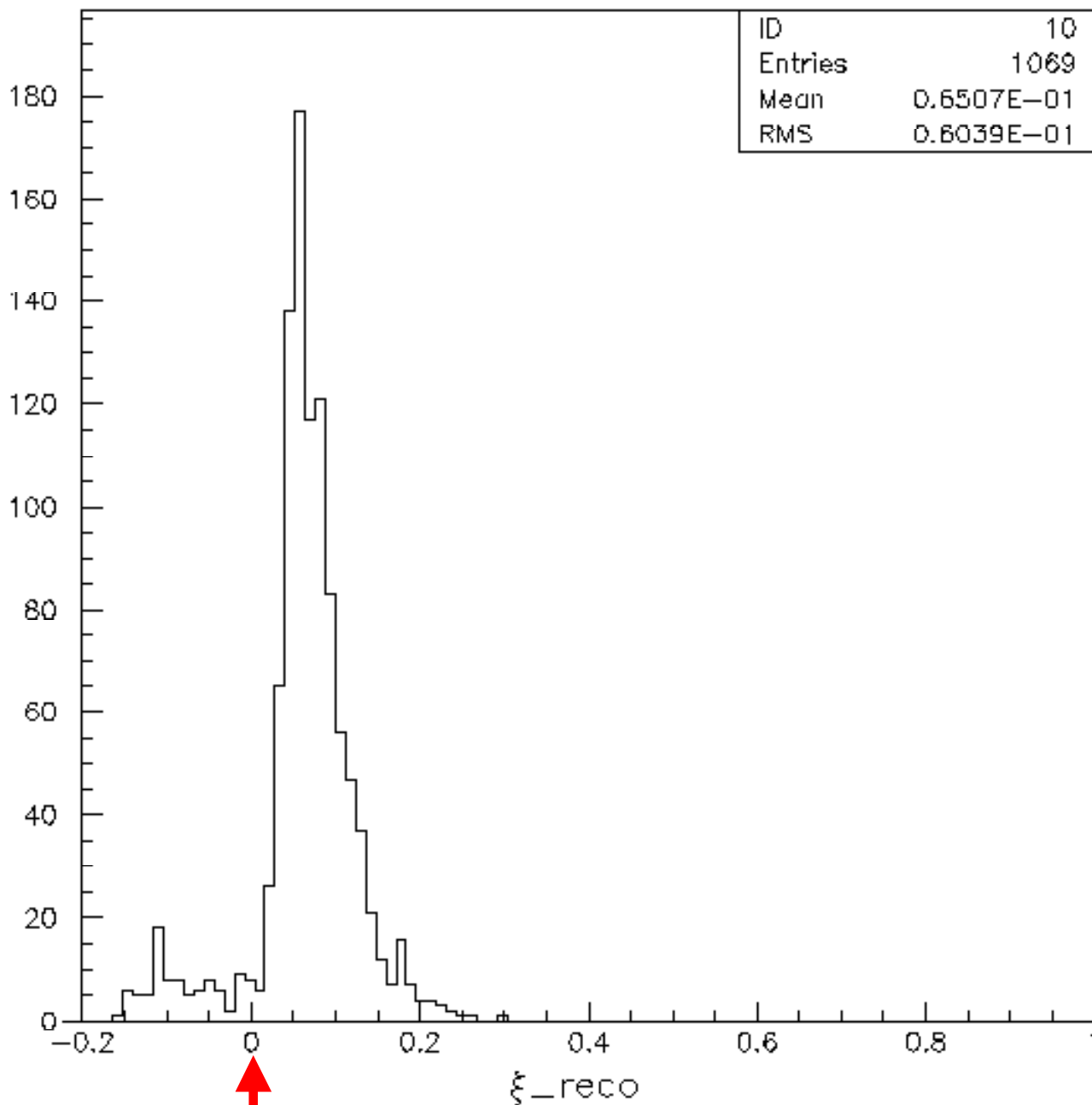
ξ=Δp/p should peak at 0 for elastic events!!
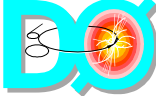
Alignment of Detectors

➢ From the data we can see a relative shift of 3mm in the x direction and 1mm in the y direction between the two detectors

PD1x vs. PD2x (mm)
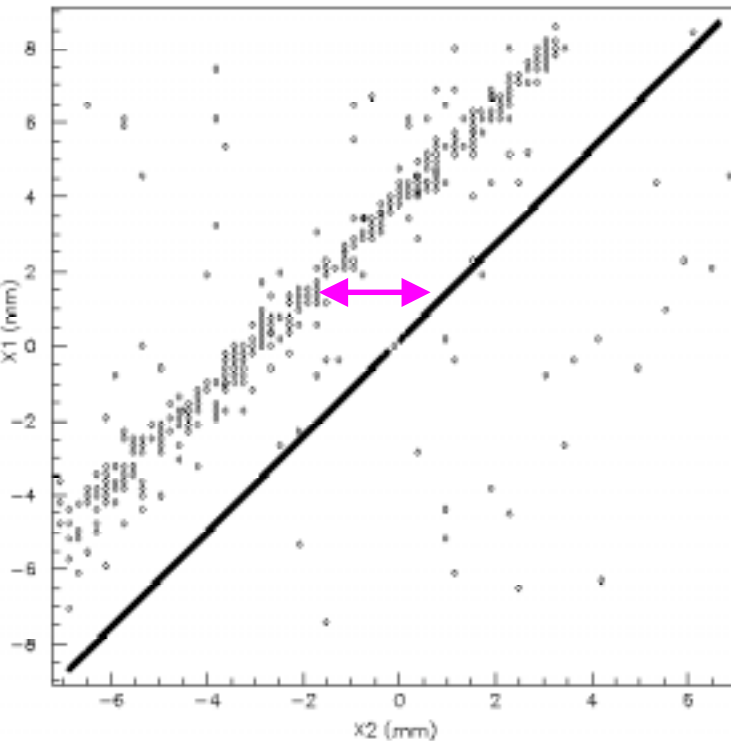
Good correlation between x1,x2 and y1,y2 in data but shifted from MC expectation (3 mm in x and 1 mm in y)

PD1y vs. PD2y (mm)
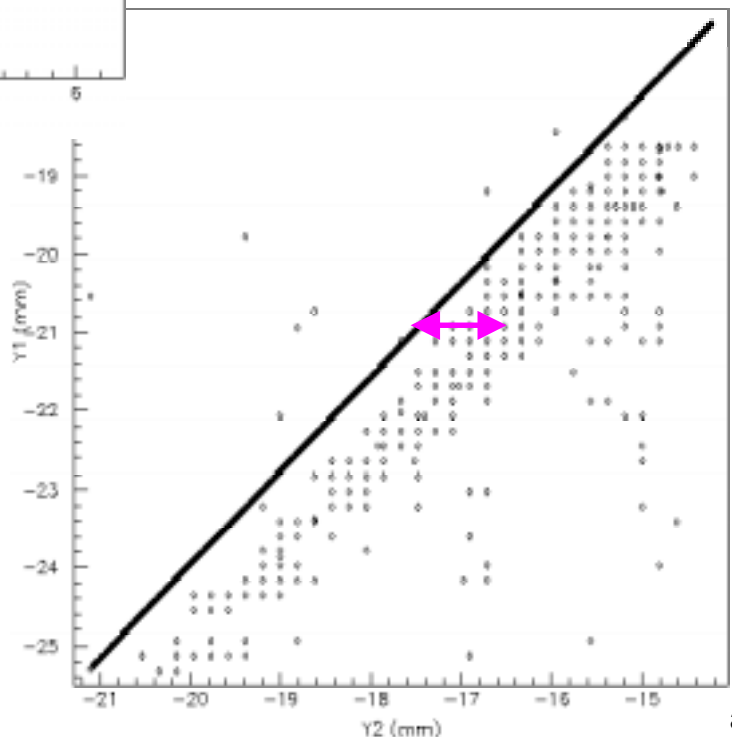
Alignment Corrected

P1D at Nominal Position – P2D Moved

Calibrated ξ now peaks at 0
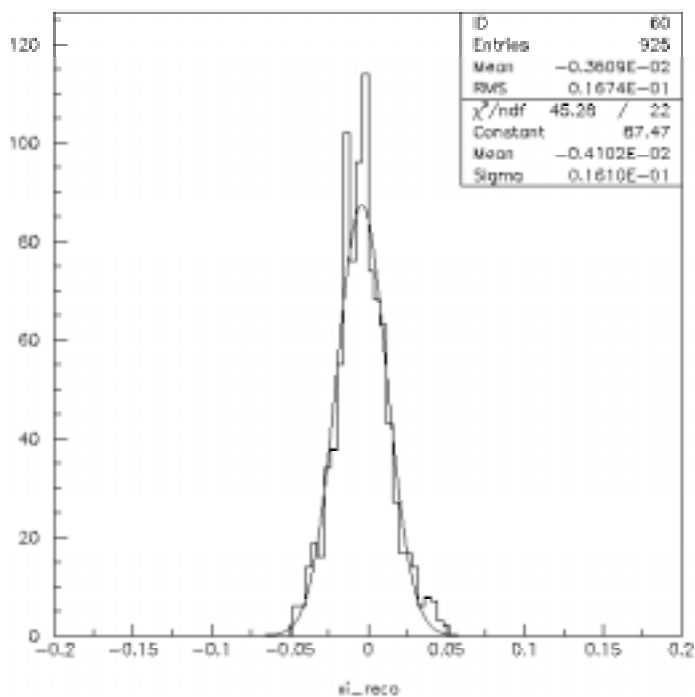
P_DOWN (Elast Data Sample Runs 74/76)
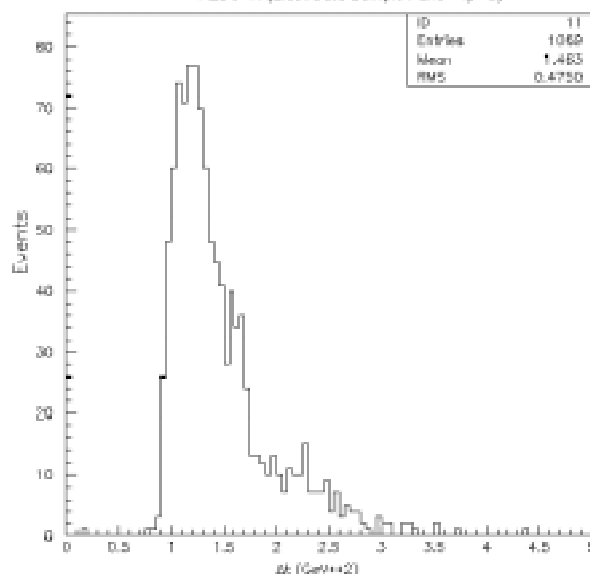
Minimum t about 1.0 Gev^2

ξ peak reasonably Gaussian, still 2x ideal MC resolution

> Using ideal detector geometry, we can try to approximate the x resolution by comparing the x coordinate of a hit from a u/v overlap with the x coordinate of the x segments with the following results.
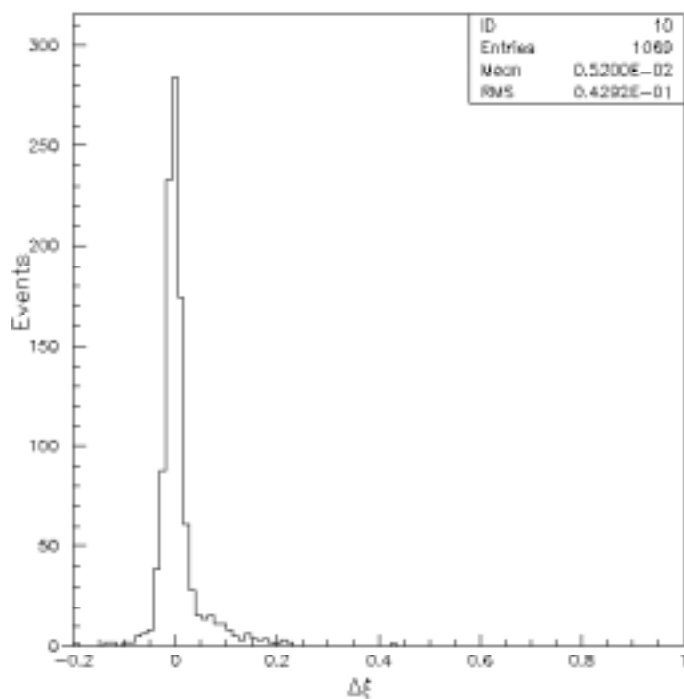

ID	19
Entries	1054
Mean	0.2282
RMS	0.2381
χ^2/ndf 154.1 / 67	
Constant	41.55
Mean	0.2203
Sigma	0.1714

Detector 1 X resolution (xzuv − x) all cuts
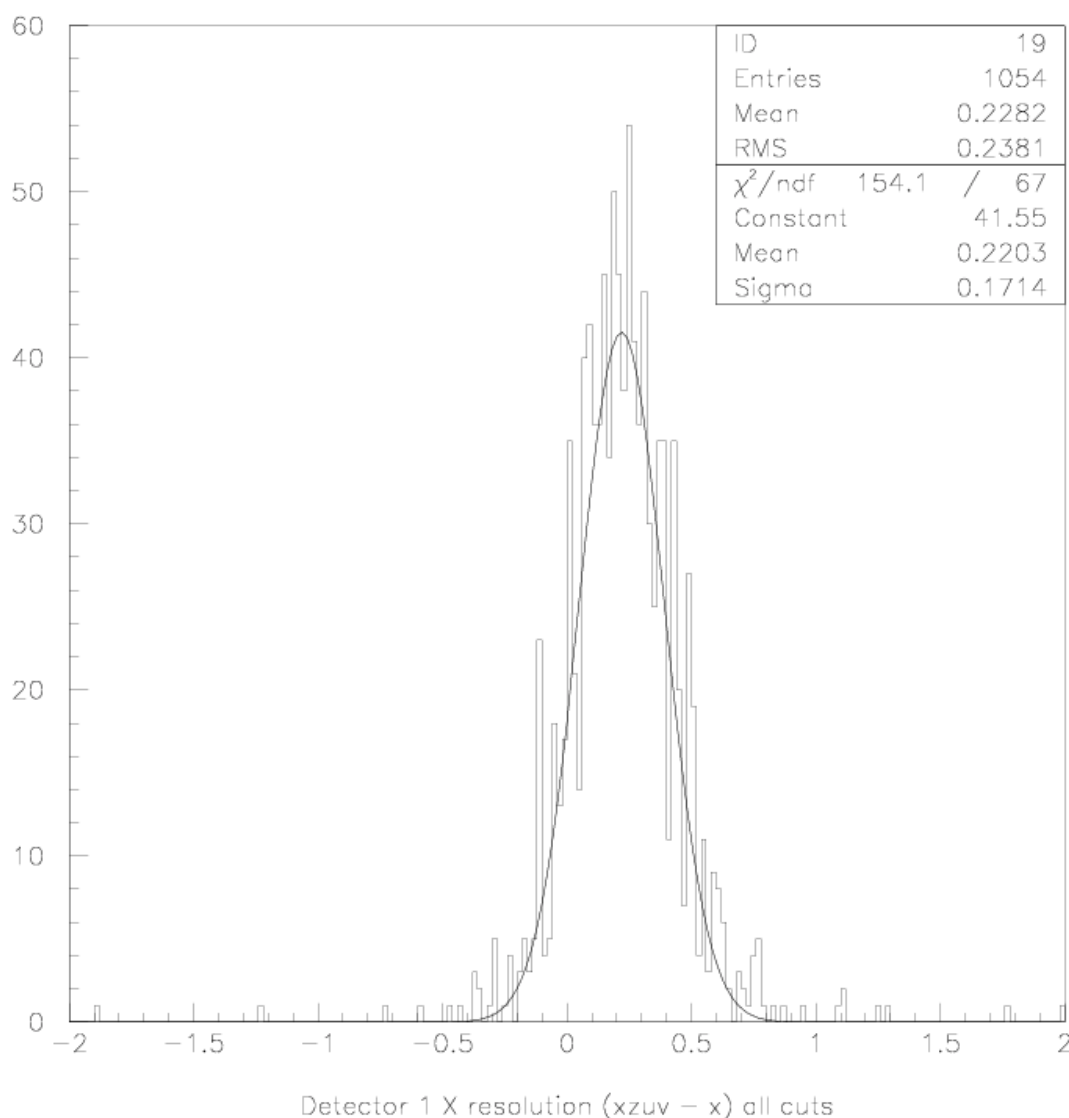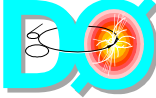
➢ Can take a first stab at fiber efficiency by looking at the number of events that have a valid u and v segment compared to the number that have valid u, v and x (can do the same with valid u, x look at v or v, x look at u)

   – Pre-pre results for runs74-78 at -940V:
   – P1D: 0.952492
   – P2D: 0.907253

➢ Still need to take into account dead channels, hot channels etc.

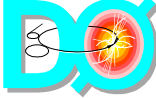Michael Strang

Additions to DAQ

➢ We have recently added the ability to the DAQ to keep a text file with each run that records the rates and times of the start and stop of each run for future inclusion in a database

   – Can be further modified to keep pot positions and voltages in text file as well

➢ Are going to reconfigure the trigger logic to make it easier to alter the trigger we are going to use to collect data

➢ Hope to move to a phase where after an FPD person inserts pots, another shifter in the Control Room can start and stop runs.
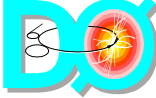
Current Problems

➢ **Dead Channels**
  – Likely due to the cables and the A/S cards

➢ **Fluctuating Pedestals**
  – Likely due to A/S cards

➢ **Poor Beam Conditions**
  – Making it difficult to insert the pots to operating positions due to singles rates (usually in A2U and P2D) starting near 100kHz.

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Future Plans

➤ Refine resolution measurements

➤ Include real detector mapping information rather than ideal detector

➤ Use TDC information to estimate z vertex position for refinement

➤ Study fiber efficiency as function of MAPMT voltage

➤ Study data at different pot positions

➤ Try to get people in Brazil involved in the data analysis effort

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